Space Weather Technical Forecast

Issued on Sunday 9 March 2025 at 12:38 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of Isolated M-class flares. G1 Minor Storm intervals expected day 1 (09 Mar) and also later day 4 (12 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C3.9 at 08/1825 UTC from just over the east limb. There are six regions on the visible disc, with the most notable the longitudinally wide AR4012 in the southwest quadrant. While this region has been relatively inactive, it does still have potential for isolated flaring due to its slightly complex magnetic field. The other regions remain small and simple. There is also the potential for a new region to rotate onto the disc from over the east limb, perhaps associated with the C3.9 flare at 08/1825 UTC.

No Earth-directed CMEs have been observed. The two eruptions on the southwest and northwest have been assessed as missing Earth.

Solar Wind / Geomagnetic Activity: An erratic connection to CH21/- was observed over the past 24 hours. Solar winds, measured by ACE at L1, erratically rose from slightly elevated levels at around 400km/s to current strong levels around 650km/s, with a peak of around 700km/s at 09/0950UTC. Density favoured being below average levels. Total Interplanetary Magnetic Field, Bt, was largely Moderate to Strong, ranging 10-19nT, peaking around 08/1610 UTC, but fell to weak levels from 08/0900UTC to end the period around 6nT. The north-south component, Bz, was weak and variable at first, but favoured a predominately Moderate negative (southward) from 08/1520 UTC to around 09/0720UTC, with minimum value -14nT. Phi angle was mainly negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3) until 08/1800 UTC, then increased to Active to G1 minor storm levels (Kp4-Kp5) from 08/1800 UTC, with a single period of G2 Moderate storm 09/0300-0600UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background. High energy electron flux (greater than 2 MeV) was mainly at Background with a period of Moderate at diurnal peak, with a maximum reaching 491 pfu at 08/1645 UTC. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), with 4.82e6 integrated pfu at 09/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is forecast, with a chance of Isolated M-class flares.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

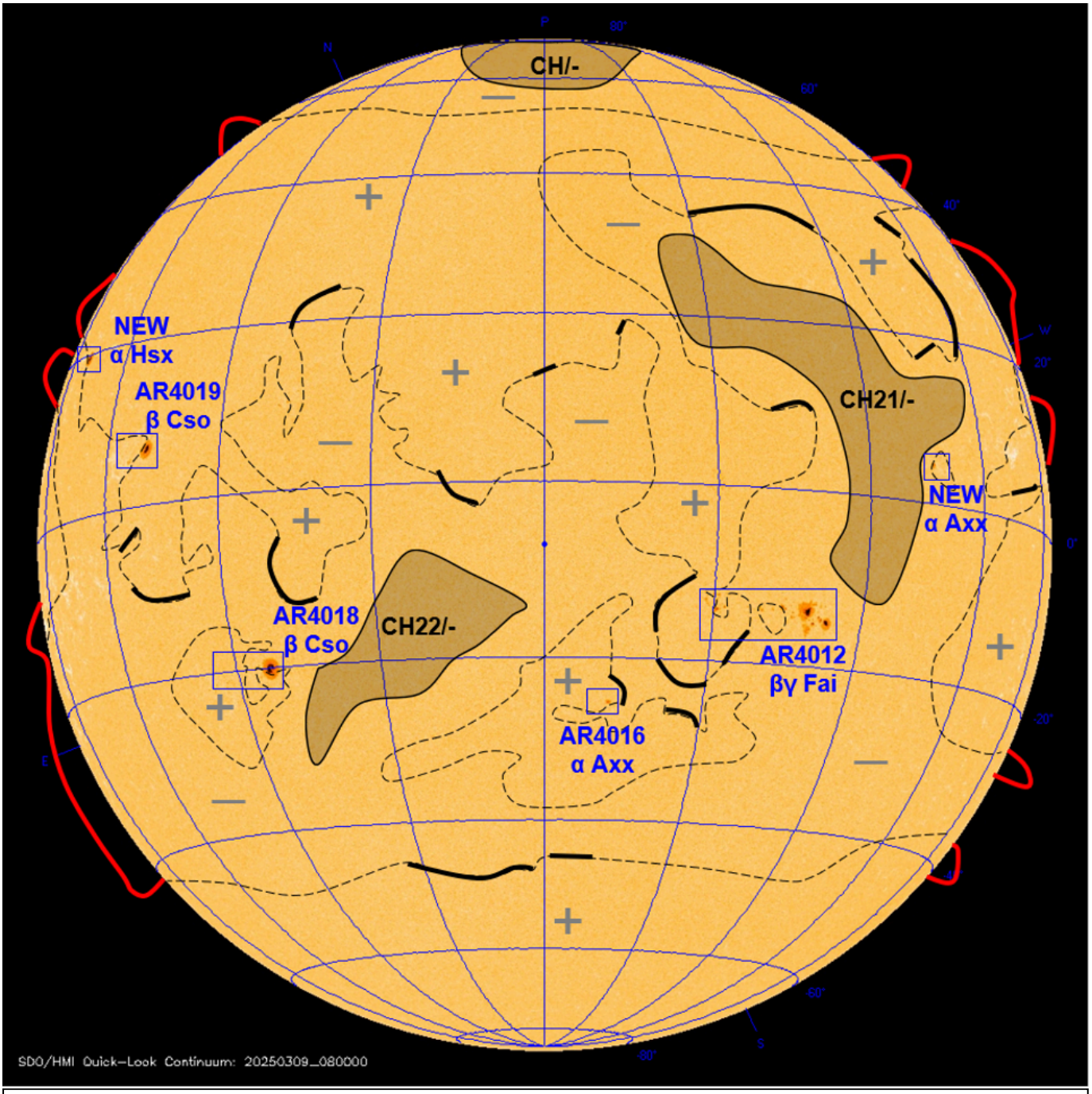
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Ongoing erratic connection to CH21/- at first is expected to ease from later day 1 (09 Mar) onward, with the next fast wind enhancement from CH22/- either late on day 4 (12 Mar) or just beyond this period. Active to G1 Minor storms are forecast at first, with a slight chance of G2 Moderate Storms. This activity will ease to become Quite to Unsettled with Active intervals day 2-3 (10-11 Mar), with a risk of further G1-G2 Minor to Moderate storms later on day 4.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at Background. High energy electron flux is expected to reach High from day 2 (10 Mar), but with some chance of dropout from the further coronal hole enhancement day 4 (12 Mar). The associated 24 hour fluence is currently below the Active threshold, but is expected to rise with a chance of reaching Active day 3 (11 Mar).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 1: MOSWOC Solar Synoptic Map 09/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Geomagnetic Storms

There are no Earth-directed CMEs, with the previous CMEs from 07 Mar now assessed as passing south and behind Earth.

Earth is now connected to CH21/- with solar wind speeds currently at strong levels of around 650 km/s. Connection to this coronal hole has been erratic, likely due to its northern disc location compared to Earth which is 7.2 deg south of the solar equator. This erratic interaction is expected to continue during Day 1 (09 Mar), but showing a gradual decline from later in the day, as supported by MOSWOC Enlil. Due to the negative polarity of the feature, which is favoured for connection at this time of year, Active to G1 Minor storms are forecast at first, with a slight chance of G2 Moderate Storms. This activity will ease to become Quiet to Unsettled with Active intervals day 2-3 (10-11 Mar).

The next coronal hole enhancement, from CH22/-, is expected to occur either late day 4 (12 Mar), but more likely on day 5 (13 Mar). This is in agreement with MOSWOC Enlil, with 27-day persistence not providing good guidance due to this feature being much reduced in terms of its western extent. However once this does connect, due to its near equator southern disc location and its negative polarity, Elevated to Strong solar winds along with a spell of G1-G2 Minor to Moderate storms are forecast.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	Yes	70	20	5	20
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 2: L1 (ACE) solar winds, showing erratic fast wind connection.

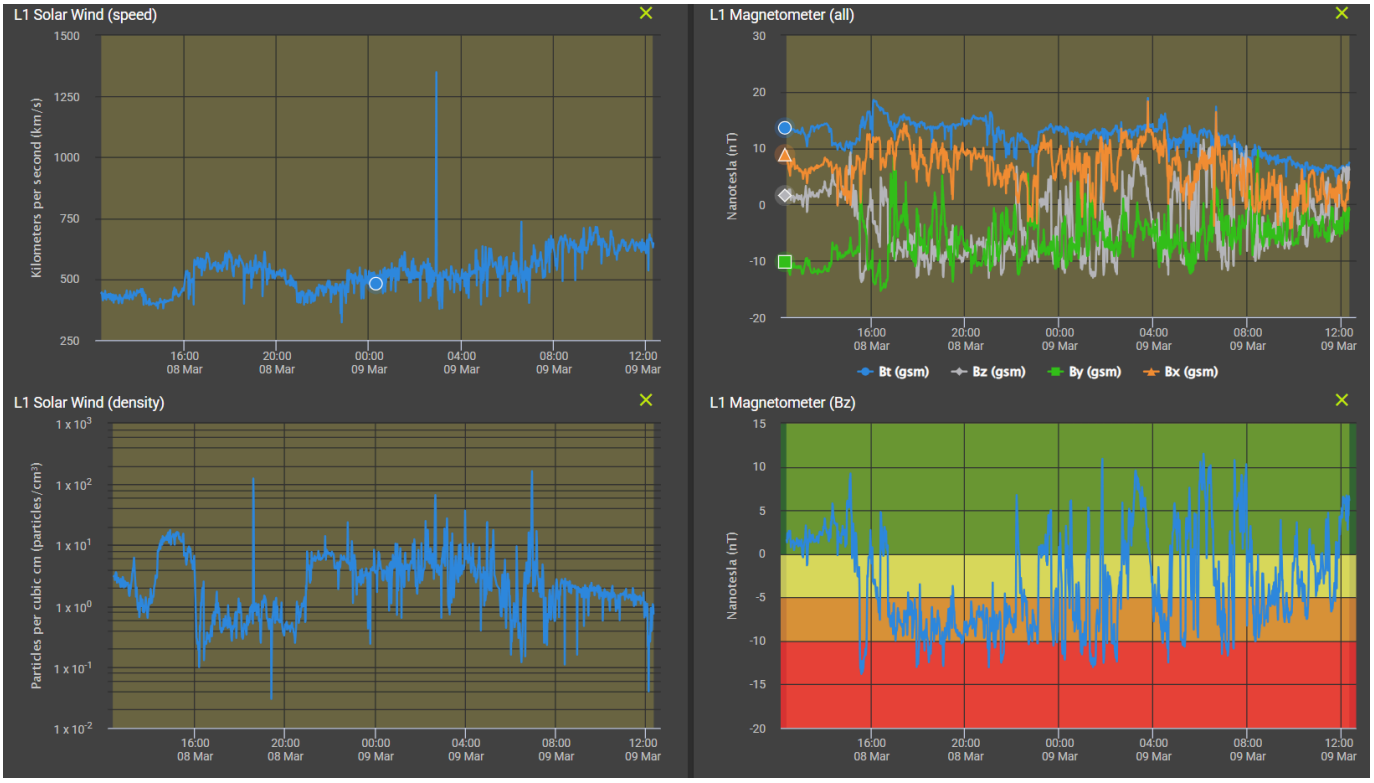
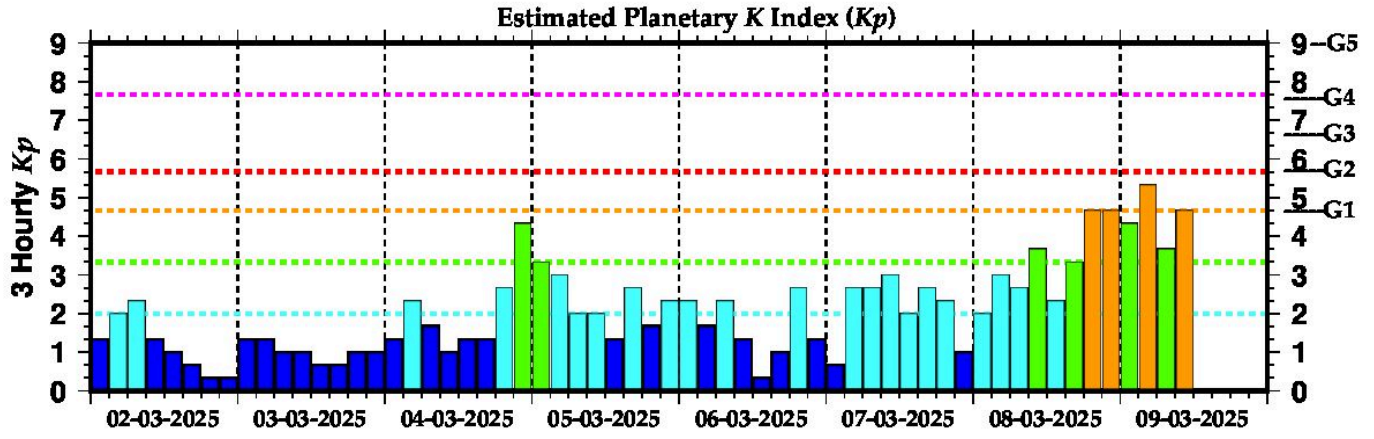


Figure 3: BGS Estimated Kp values.



© Crown Copyright 2025. All Rights Reserved.

Radio Blackouts - X-Ray Flares

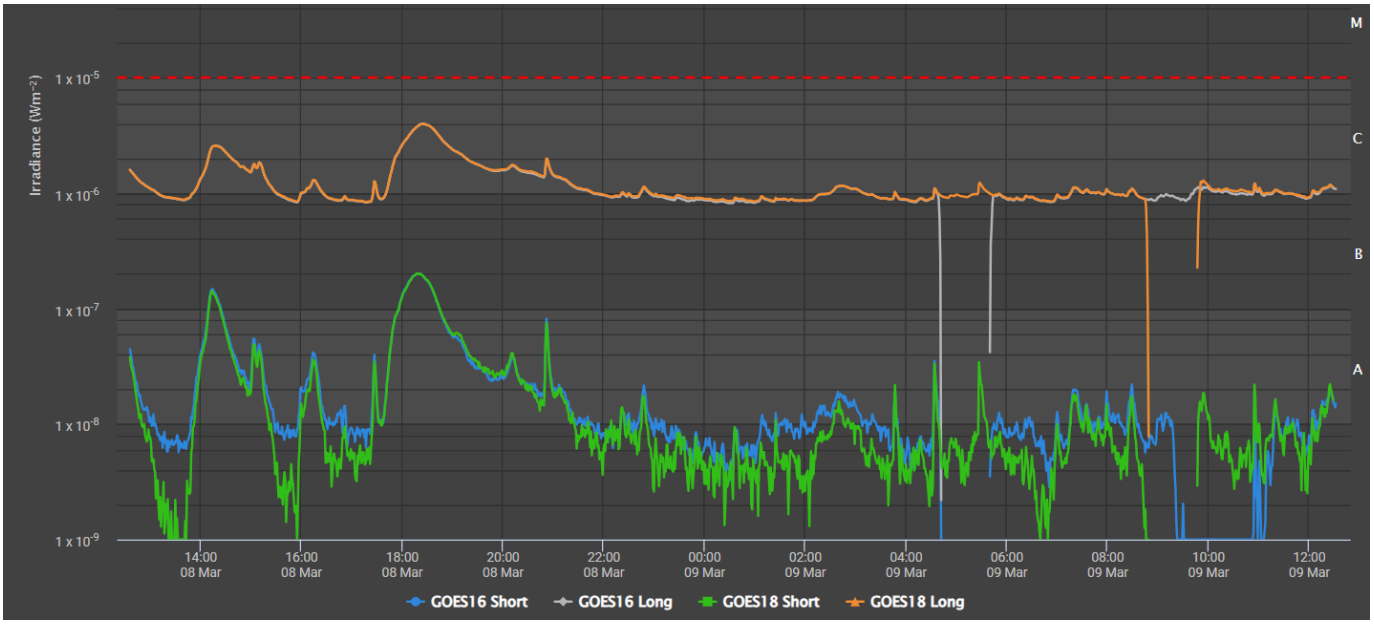
There are six sunspot regions currently on the Earth-facing disc, however these are all relatively small and simple, with only a slight chance of flaring. The main exception is AR4012 in the southwest, which is a larger and much wider group. Activity from this region has been very limited, with some recent sign of decay. However, there has been some ongoing slight development of the small spots around its leader, and the associated magnetic loops above the region have shown some brightening in e.g. SDO aia-211.

The other main source of activity is likely to be from a bright region of magnetic looping evident on the southeast limb. This was likely related to a C-flare and prominence eruption late on 08 Mar, and perhaps could indicate a new region to rotate onto the disc in the next 24-48 hours, although this is low confidence.

Due to these potential regions a chance of isolated M-class flares is maintained through the period, with activity expected to be Low to Moderate.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 4: GOES 16/18 X-ray Irradiance



© Crown Copyright 2025. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux is expected to persist at Background, with the current regions on the disc unlikely to produce events that would give a notable enhancements.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

The high-energy electron flux (>2MeV) as observed at GOES16 is forecast to be at mainly background at first, but then rising as solar winds and geomagnetic activity eases from the recent fast wind connection. This will lead to Moderate flux, and an increasing chance of persistent High flux later day 2 (10 Mar). Confidence is low for the longevity of this high flux however due to the potential fast wind onset from CH22/- later on day 4 (12 Mar), providing the potential for drop out of the observed flux at GEO.

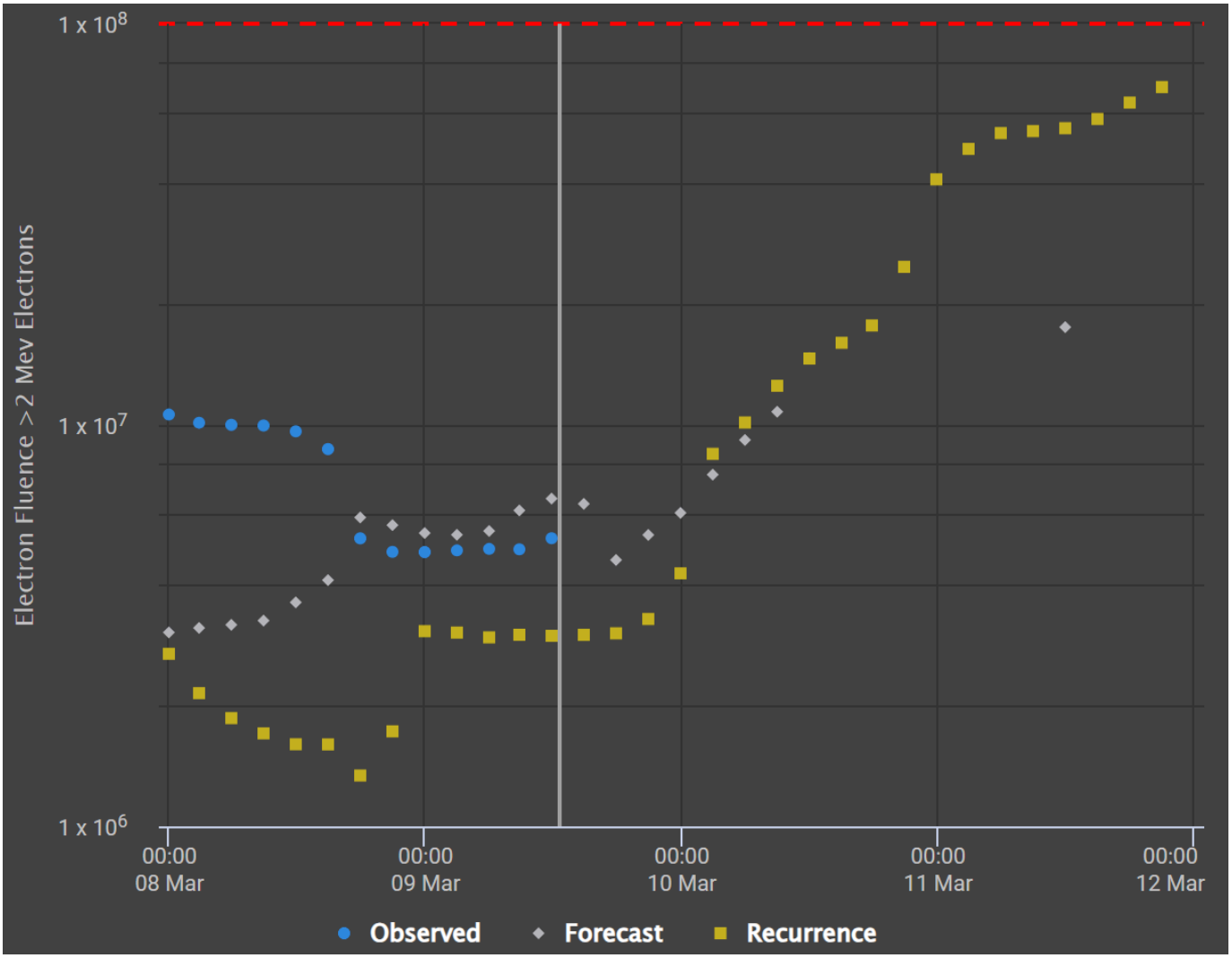
The associated fluence 24 hour is subsequently expected to rise through much of the period, with an increasing chance of reaching the Active threshold by day 3 (11 Mar). With the source of this enhancement being similar to the previous rotation, recurrence is likely providing the best guidance, albeit with the potential for this enhancement to occur sooner due to the likely reduction in solar winds on day 1-2 (09-10 Mar), which was not observed on the previous rotation. MOSWOC REFM has not yet taken account of the recent fast wind onset, and is currently providing poor guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	5	20	50	50
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 5: MOSWOC REFM and 27-day Recurrence



© Crown Copyright 2025. All Rights Reserved.